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PATENT
Atty Docket No.: A4231/T34410
AMAT Ref. No.:
004231/USAD01/DD/HDP/CVD/JW
TTC Ref. No.: 16301-034410

By: Kevin L. McNeill

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

Michael Kwan, et al.

Application No.: 09/648,395

Filed: September 24, 2000

For: GAS CHEMISTRY CYCLING TO
ACHIEVE HIGH ASPECT RATIO
GAPFILL WITH HDP-CVD

Examiner: Ghyka, G.

Art Unit: 2812

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

Prior to examination of the above-referenced application, please enter the
following amendments and remarks.

IN THE CLAIMS:

Please cancel Claims 1-16 so that the pending claims read as follows:

- 1 17. (Unchanged) A computer-readable storage medium having a
- 2 computer-readable program embodied therein for directing operation of a substrate
- 3 processing system including a process chamber; a plasma generation system; a substrate
- 4 holder; and a gas delivery system configured to introduce gases into the process chamber,
- 5 the computer-readable program including instructions for operating the substrate

1 processing system to deposit a dielectric film on a substrate disposed in the process
2 chamber in accordance with the following:

3 (a) providing a first gaseous mixture to the process chamber, the first
4 gaseous mixture comprising a first deposition gas and a first inert gas source;

5 (b) generating a first high-density plasma from the first gaseous
6 mixture to deposit a first portion of the film on the substrate with a first deposition/sputter
7 ratio within the range of 5 – 12, wherein the first deposition/sputter ratio is defined as a
8 ratio of a sum of a first net deposition rate and a first blanket sputtering rate to the first
9 blanket sputtering rate;

10 (c) thereafter, cooling the substrate;

11 (d) thereafter, flowing an etchant gas into the process chamber;

12 (e) thereafter, providing a second gaseous mixture to the process
13 chamber, the second gaseous mixture comprising a second deposition gas and a second
14 inert gas source; and

15 (f) generating a second high-density plasma from the second gaseous
16 mixture to deposit a second portion of the film on the substrate.

17 18. (Unchanged) The computer readable storage medium according to
18 claim 17 wherein the second high-density plasma is generated to deposit the second
19 portion of the film with a second deposition/sputter ratio within the range of 5 – 20,
20 wherein the second deposition/sputter ratio is defined as a ratio of a sum of a second net
21 deposition rate and a second blanket sputtering rate to the second blanket sputtering rate.

22 19. (Unchanged) The computer-readable storage medium according to
23 claim 17 wherein the dielectric film is to be deposited over a plurality of stepped surfaces
24 formed on the substrate having gaps formed between adjacent ones of the stepped
25 surfaces and wherein the first portion of the film partially fills the gaps.

26 20. (Unchanged) A substrate processing system comprising:

27 (a) a housing defining a process chamber;

28 (b) a high-density plasma generating system operatively coupled to the
29 process chamber;

- 1 (c) a substrate holder configured to hold a substrate during substrate
2 processing;
- 3 (d) a gas-delivery system configured to introduce gases into the
4 process chamber;
- 5 (e) a pressure-control system for maintaining a selected pressure
6 within the process chamber;
- 7 (f) a controller for controlling the high-density plasma generating
8 system, the gas-delivery system, and the pressure-control system; and
- 9 (g) a memory coupled to the controller, the memory comprising a
10 computer-readable medium having a computer-readable program embodied therein for
11 directing operation of the substrate processing system, the computer-readable program
12 including
- 13 (i) instructions to control the gas-delivery system to provide a
14 first gaseous mixture to the process chamber, the first gaseous mixture comprising a first
15 deposition gas and a first inert gas source;
- 16 (ii) instructions to control the high-density plasma generating
17 system to generate a first high-density plasma from the first gaseous mixture to deposit a
18 first portion of the film on the substrate with a first deposition/sputter ratio within the
19 range of 5 – 20, wherein the first deposition/sputter ratio is defined as a ratio of a sum of
20 a first net deposition rate and a first blanket sputtering rate to the first blanket sputtering
21 rate;
- 22 (iii) instructions to control the gas-delivery system thereafter to
23 flow a heat-transfer gas to cool the substrate;
- 24 (iv) instructions to control the gas-delivery system thereafter to
25 flow an etchant gas into the process chamber;
- 26 (v) instructions to control the gas-delivery system thereafter to
27 provide a second gaseous mixture to the process chamber, the second gaseous mixture
28 comprising a second deposition gas and a second inert gas source; and

1 (vi) instructions to control the high-density plasma generating
2 system to generate a second high-density plasma from the second gaseous mixture to
3 deposit a second portion of the film on the substrate.

4 21. (Unchanged) The substrate processing system according to claim
5 20 wherein the instruction to generate a second high-density plasma comprise
6 instructions to deposit the second portion of the film with a second deposition/sputter
7 ratio within the range of 5 – 20, wherein the second deposition/sputter ratio is defined as
8 a ratio of a sum of a second net deposition rate and a second blanket sputtering rate to the
9 second blanket sputtering rate.

22. (Unchanged) The substrate processing system according to claim
20 wherein the dielectric film is to be deposited over a plurality of stepped surfaces
formed on the substrate having gaps formed between adjacent ones of the stepped
surfaces and wherein the first portion of the film partially fills the gaps.

REMARKS

This application is a Divisional Patent Application of Appl. No. 09/648,395 filed August 24, 2000 ("the parent application"). On June 5, 2001, Claims 17-22 were subjected to an oral restriction requirement by the Examiner and were withdrawn when Applicant's representative elected Claims 1-16. Accordingly, Claims 17-22 are presented in this Divisional Application.

Since no amendments have been made to individual claims - Claims 17-22 are presented in the same form as in the parent application and there are no new claims - no Appendix is provided to highlight changes made to the claims.

CONCLUSION

In view of the foregoing, Applicants believe all claims now pending in this Application are in condition for allowance. The issuance of a formal Notice of Allowance at an early date is respectfully requested.

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